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ABSTRACT

To determine how the difficulty of print materials affected elementary school students' sight copying accuracy and productivity and to explain correlate variance related to copying, 149 students in grades four, six, and eight were assigned materials to copy for three minutes. All subjects copied passages at grade level and at two grades above and below grade level. Each passage received a productivity score and an error rate score. Analyses of variance and covariance were used to evaluate the data collected. The findings indicated that (1) productivity increased with students' grade level; (2) girls' productivity was superior to boys' at grades four and eight; (3) although affecting productivity, differences in difficulty levels revealed a pattern generally unrelated to increasing readability; (4) productivity was affected only slightly by the differences in material difficulty at grades six and eight; (5) the average number of errors decreased at each higher grade; and (6) the relationships between Canadian Test of Basic Skills subtests and both copying productivity and accuracy were mixed. (Appendixes include test scores, sample passages, scoring criteria, and student responses.) (Author/MM)

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THE EFFECT OF READABILITY ON SIGHT COPYING IN ELEMENTARY SCHOOL GIRLS AND BOYS

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1983

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The Effect of Readability

on Sight Copying

in Elementary School Girls and Boys

A Thesis
Submitted to the College of Graduate Studies and Research
in Partial Fulfilment of the Requirements
for the Degree of
Master of Education
in the
Department of Curriculum Studies
College of Education
University of Saskatchewan

by

Margaret Polanik

Saskatoon, Saskatchewan

September, 1983

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ABSTRACT

The purpose of this investigation was to determine the effect print materials with three levels of readability have on the sight copying productivity and accuracy of boys and girls at three grade levels. It was also designed to explain variances of correlates which may be related to copying. The sample of 149 grades four, six, and eight students were randomly assigned materials to copy for three minutes. All subjects copied a passage two grades below grade level, at grade level, and two grades above grade level. Each passage received a productivity score and an error rate score. Analysis of Variance (ANOVA) and Covariance including repeated measures were used to analyze the data collected.

The main findings indicate that each higher grade had greater productivity than the previous grade tested. Girls' productivity at grades four and eight were superior to boys at a statistically significant level. Differences between difficulty levels affected productivity, but in a pattern generally unrelated to increasing readability. The differences in productivity between the difficulty levels at grades six and eight were slight, thus pairwise comparisons failed to indicate which difficulty level was causing the significant differences. The average number of errors decreased at each higher grade. Girls, at each grade level, made fewer errors than boys, though only chance differences prevailed. The relationships between Canadian Test of Basic Skills subtests and both copying productivity and accuracy were mixed, tending to be moderate, at best.

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DEDICATION

To

Heather Ann

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Chapter 1

INTRODUCTION TO THE CHAPTER

The Problem

The purpose of this study was to analyze the effect different levels of difficulty have on the rate and accuracy of sight copying at grades four, six, and eight, and to examine correlates between sight copying and Canadian Test of Basic Skills Subtests.

Specifically, the study sought answers to the following questions:

1. Are there sex differences according to the rate and accuracy of sight copying?
2. Does the level of difficulty of passages to be copied affect the rate and accuracy of sight copying?
3. How are sight copying productivity and accuracy correlated with students' reading, spelling, language, and mathematics scores as measured by the Canadian Test of Basic Skills (C.T.B.S.)?
4. What productivity expectations are there in grades four, six, and eight?

Background and Need for the Study

Copying is an important skill that both children and adults use almost every day in one form or another. Over fifty years ago, Thompson (1931) wrote:

> It is rather surprising to discover how little attention has been paid by educators to the minor skill of copying, considering the large use made of it both in school and in adult life. The writer has just finished examining fifty books in only

> eight of which copying was accorded any attention at all further than the suggestion that the children be required to copy some sentences, poems and the like; and of the eight, only five made even the most elementary analysis of the exercise. (p. 88)

Minimal attention continues to be given in the area of copying over the last 50 years. A manual search of textbooks in the language arts area and a computer search of the literature identified 30 to 40 articles for which copying is a descriptor, but few articles pertain to this study. The bulk of the articles deal with copying as it relates to visual perception and eye-hand coordination. With the exception of three articles (Kirk, 1980; Klein, 1981; Kovitz, 1982) analyzing copying ability, all others identified in the literature as pertinent to this study came mainly from handwriting research.

Perhaps copying is dismissed because researchers believe copying is a simple task when, in fact, it is a highly complex act. Kovitz (1982) concludes copying involves a strategy and a number of skills including visual-motor coordination, visual memory, identification, and discrimination, spatial relationships, visual sequencing, left-to-right orientation, coupled with the ability to concentrate and be methodical. Further explanation of the importance of these skills is given in Chapter 2.

Importance of Copying

Frequency of Using Copying Skills

Thompson (1931) described 20 situations ranging from copying recipes to filing Income Tax Returns where copying skills were needed. She indicated that this was by no means an exhaustive list. In her

article, she also reported that many people use copying in their jobs. She stated that the list would include students, teachers, office clerks, mail clerks, sales people, stenographers, secretaries, ministers, lawyers, doctors, housewives, grocers, druggists, chemists, librarians, nurses, and many more. Thompson also listed 41 different kinds of copying including: letters, words, sentences, paragraphs, outlines, poetry, music, maps, diagrams, copying another person's writing or one's own writing, copying from the blackboard to the desk, from the book to the desk, from print to script, and from script to script.

Even today copying is widespread in schools as children continue to copy from the page, blackboard, and the screen. To illustrate how much copying is being used in schools, Fillion (1979) conducted three surveys in Toronto area schools during 1977-1978. He defined copying as "anytime where the student was simply taking down information directly from some source" (p. 52). In the first survey, he found that 21% of the total writing output in grade seven and eight was in the form of copying. A second survey showed that in grade seven, 30% of the writing was copied, in grade eight, 23% was in the form of copying, and in grade nine, 55% was copy work. Fillion's (1979) third survey was conducted in grades nine to thirteen. Across grades, 37% of the writing was copied with great differences among school subjects: English - 14%, Geography - 18%, Business - 35%, Family Studies - 38%, History - 47%, Science - 50%, Math - 71%, and Technical - 76%.

Applications of Copying

Although Fillion (1979) has reservations about copying, it is quite

possible that some students learn best using kinesthetic techniques. Physically hand copying an item may bring together the aural and visual stimuli to aid in the learning process. Some basic writing programs have kinesthetic elements in them. For example, "Write Me a Ream" (Kunz & Viscount, 1973) and "Composition: Guided→Free" (Dykstra, Port & Port, 1978) use copying to teach patterns and the feel for writing sentences and paragraphs. Through simple substitution in the lower levels and more complex changes in the higher levels, the students progress step by step through various stages in writing by making use of their copying abilities.

"Write Me a Ream" (Kunz & Viscount, 1973), a course in controlled composition for adults who have been unsuccessful at learning to write effectively, utilizes copying skills to develop effective writing techniques. The authors wrote 60 model passages, each of which has two or more graduate steps to accomplish. There are 26 steps in the program. The student in the first step copies the model passage and in subsequent steps makes the required revisions using the model provided, as is shown in the following sample.

"What For?"

[1]A young man who is born of a wealthy family has a lot of leisure time on his hands.

[2]He can afford to indulge himself. [3]He runs around Europe with the Jet Set. [4]He has the time to play tennis and sail his boat. [5]He goes to the races when he feels like it.

[6]He finds it very easy to get a job since his family's friends are likely to be wealthy businessmen. [7]Also, it is possible for him to work for his own father.

[8]His life is certainly easy. [9]However, he wastes most of his time and energies. [10]He should say to himself, "What for?"

1. Copy the entire passage.

4. Rewrite the entire passage changing the words a young man to young men. This means that you will be writing about many young men instead of just one throughout your composition. Your first sentence will be:

   Young men who are born of wealthy families have a lot of leisure time on their hands.

23. Rewrite the entire passage joining sentences 2 and 3, sentences 4 and 5, and sentences 8 and 9 with words like and, so, or but. Leave out the word however in sentence 9.

    Note: You must leave out any subjects that are repeated when the two sentences are joined.

Before students advance from one step to the next, the previous step must be error-free. If it is not error-free, they must repeat the same step using different models until that step is perfectly correct. Through this program, which uses students' copying abilities, students become more proficient in spelling, punctuation, capitalization, grammar, and handwriting. They are also taught to proofread efficiently and effectively since they must compare their copy to the original model.

A similar self-paced program is "Composition: Guided→Free" (Dykstra, Port & Port, 1978). The authors' belief of this program is that students learn to write by writing. The writing practice is controlled in such a way to enable the students to produce the writing of error-free papers. The ultimate aim of their program is free or independent writing.

The program has 12 booklets sequenced step by step according to the degree of difficulty. Each booklet is a complete program in itself

and builds upon skills practised in previous booklets. These booklets are designed to be used with lower elementary students where few original contributions are expected, to an adult level where higher level tasks which require more contributions are expected.

As in "Write Me a Ream" (Kunz & Viscount, 1973), students must successfully complete one step before advancing to the next step. If unsuccessful, they must go to another model that has the same step and complete it. Once a perfect paper is achieved, they may go on to the next step.

The following is an example of a model passage from booklet six:

"Fifty Cents and Two Box Tops"

David looked at the picture on the back of the cereal box and noticed the expiration date. "If I enclose fifty cents and two box tops, they will send me a double giant gravity rocket. If I receive this rocket, I will show it to all my friends. If I use this rocket with the special giant rubber band, the rocket will rise over a hundred feet in the air." David's mother knew from experience that these advertisements usually exaggerate the product's performance. She wanted to explain this to him. However, now was not the time to tell him.

1. Write this story changing rocket to spaceship each time it appears.

13. Write this story leaving out all the clauses that begin with if. The second sentence will read They will send me a double giant gravity rocket.

15. Write this story changing the second sentence to "If I enclosed fifty cents and two box tops, they would send me a double giant gravity rocket." Change all the sentences inside quotation marks in the same way. Be sure to change receive, will, and use.

17. Write this story changing the second sentence to "If I had enclosed fifty cents and two box tops, they would have sent me the double giant gravity rocket." Change all the sentences inside quotation marks in the same way. Be sure to change receive, will, show, use, and will rise.

42. Write a story of your own telling about something you sent away for.

Both "Write Me a Ream" (Kunz & Viscount, 1973) and "Composition: Guided→Free" (Dykstra, Port & Port, 1978) allow the students to use their copying abilities to develop free writing skills. The student is never faced with the trauma of an empty page or a page full of red marks.

Somerset Maugham (1938) in his book, "The Summing Up," pointed out that, at an early age, he used copying to develop his writing skills. He states:

> I studied out Jeremy Taylor's Holy Dying. In order to assimilate his style I wrote out passages and then tried to write them down from memory. . . . It looks as though Swift made do with the first word that came to hand, but since he had an acute and logical brain it was always the right one, and he put it in the right place. The strength and balance of his sentences are due to an exquisite taste. As I had done before, I copied passages and then tried to write them out again from memory. I tried altering words or the order in which they were set. I found that the only possible words were those Swift had used and that the order in which he had placed them was the only possible order. (p. 25)

Weathers and Winchester (1969) further support that copying or imitating a writer's style should be used initially to develop a person's own writing style. They advise:

> To imitate the masters, to make sussessfully established devices part of our own writing repertoire, we need, of course, to understand what is happening in the words in front of us. Copying is a most successful and expedient method of achieving that understanding. Copying the passage -- physically copying it in our own handwriting -- breaks the spell of the passage, and the words we have copied help to suggest words of our own. Our ultimate goal is to approximate the manner and style of the great writers so that we may present more effectively and powerfully the ideas and observations that originate in our own minds. But first, we

> must follow the great writers through their own words and copy down their expressions of their ideas. In the beginning we must "serve an apprenticeship" by imitating these highly competent writers. It is an apprenticeship that promises, upon completion, the achievement of a true creation of originality. (p. 2)

The above writers go on to say that copying another writer's words requires certain skills. First, copiers must read the model sentence or paragraph carefully to gain understanding of the message being conveyed. They must have their own response to the way it was written. The copiers must next look at the structure of the sentence or paragraph and the style of it. Finally, they relate:

> We should make a copy of the model--in ink on clean white paper in our most legible handwriting. This copy should be made with a great deal of concentration; it should be made thoughtfully and accurately. We must copy the model exactly--with every comma, every dash, and every period. . . . Having copied a model, word for word, in our own handwriting, we next choose a subject of our own, one as distinct and different from the content of the model as possible. Then we write our own passage, keeping in mind the general syntax, diction, phrasing, and any special characteristic of the model. (p. 3)

The authors sum up the importance of using copying to develop writing skills by saying, "By becoming thoughtful, practicing copyists, we can more easily achieve the goal of good writing" (p. 4).

Reading programs such as "Breakthrough to Literacy" (Mackay, Thompson & Schaub, 1973) use copying as a method to develop reading, writing, and handwriting skills. Using the "My Sentence Maker" from the program encourages children to model the sentence the teacher and they have constructed orally. At the beginning stages of the program the teacher copies the sentence onto chart paper or in the child's notebook. Later the children are encouraged to copy the teacher's

model onto their own notebook. Directional skills, spacing skills, punctuation, capitalization, and the like are taught throughout the program as they are needed. By using the "My Word Maker," the child once again copies from the model provided to gain proficiency in spelling skills.

Other researchers such as Affleck (1963), Corcoran (1970), Dallman (1976), and Thompson (1931) agree that copying can be used to develop reading, writing, and handwriting skills. At an early age, we use a child's copying ability to develop fine motor coordination. Teachers or parents may ask children to copy their names or some kind of figure on a piece of paper using the model provided. Tracing over partially drawn objects is another form of copying that teaches fine motor coordination. Developing visual perception is often done by having the child copy some shape or figure that the teacher has drawn.

Whenever we ask children to find a word from a list of words that would correctly complete the sentence, we are asking them to use their copying skills. This type of activity is begun as early as grade one and extends throughout all grade levels. It can also be used, especially at the primary level, to strengthen reading, language, word recognition, word meaning skills, and children's comprehension abilities.

Basal reading programs such as "Starting Points in Language Arts," Level Five (Dean & Kambeitz, 1978), show how the following type of activity can be used to review the skill of proper spacing between words when printing or copying sentences, as well as punctuation and capitalization skills.

1. "You are beautiful," said the princess.

2. "Come and see my pictures," called John.

The teacher is directed in the manual to review the following skill of copying sentences by doing the following steps:

1. Have one or more students read the sentence aloud.

2. Have the children notice the capital letter at the beginning of the sentence and explain in their own words the reason for the use of the capital letter.

3. Direct attention to the quotation marks, the comma, and the period. Have the students note the position of each punctuation mark and then briefly discuss the reason for the use of each one.

4. Ask the group to look at the whole sentence carefully.

5. Direct the children to carefully print the sentence on their lined papers.

6. Have the children compare their printing with the model sentence to be sure that both sentences are exactly the same.

7. Remind the students to check to be sure they printed each punctuation mark exactly where required in the sentence.

Handwriting skills are developed also through copying. In the D'Nelian (Thurber, 1975) handwriting program, the students are told by the voice on the taped lessons to carefully watch the teacher as he forms the letters on the board. The students are then required to copy or model what the teacher has written.

The learning of new spelling words can be taught directly or indirectly through the use of copying skills. Students may ask how to spell a certain word and the teacher prints that word on the board. The students may then copy it onto their piece of paper or perhaps copy it into a word dictionary where they can retrieve the word at a

later date. In many spelling programs such as Spelling in Language Arts (Kuska, Webster, The School Sisters of Notre Dame, Cornwall & Richards, 1976), copying is used to teach spelling words through the use of visual memory channels. The manual directs the teacher to allow the students a few seconds to study a word, after which the students are to copy the word five times on their paper, checking each time to be sure all the letters are in the right order. Then the students are to enter the words in their spelling notebook. The spelling exercises themselves often require the student to copy words or sentences.

Copying can be used when teaching dictionary skills. One of the first tasks to learn in teaching dictionary skills is alphabetical order. Children may be asked to copy a short list of letters or words in alphabetical order. In grade three and up, we ask children to find guide words and meanings of certain words. This requires some copying skills.

As Fillion (1979) stated, copying is used to a large degree in the content area subjects. This type of copying is used for the purpose of reinforcing a concept as well as providing an opportunity for students to study or recall the information at a later date.

Teachers indicated to this researcher that they use copying in their classrooms to teach organizational skills. By copying the teacher's model, the students learn the correct format of copying various types of material.

There is a need then for educators to realize how important copying is as a skill. Some questions in need of research are: What length of time should it take students at various grade levels to sight copy a

2,000 symbol passage and how accurate should educators expect the copied work to be? Does level of difficulty of material to be copied make a difference in rate and accuracy of copying? and, how does sex, reading, or mathematical ability of the student affect the rate and accuracy of sight copying?

Definition of Terms

Sight Copying

Reproducing written work from a model. For this study, sight copying is reproducing written work from a model without any prior exposure to the material.

Productivity Score

Number of reproduced symbols in a specified amount of time, including additional letters, punctuation, reversals, repeated words, and new words. In other words, all written symbols on the paper are counted whether correctly or incorrectly copied.

Error

Any deviations from the original model including additions, omissions, crossouts, punctuation errors, and the like.

Error Rate

The number of symbols that deviate from the original model, divided by the total number of reproduced symbols, multiplied by 100.

Level of Difficulty

The measurement of reading difficulty of material resulting from the application of Fry's Readability Formula.

Limitation of the Study

The sample consisted of 149 boys and girls in grades four, six, and eight from two schools in a lower middle class neighborhood selected by the Superintendent of the Separate School Board in Saskatoon, Saskatchewan, during the 1979-1980 school year. An analysis of their CTBS scores indicated that the students are a sample of English speaking Canadian urban students of average reading ability as indicated by the means of a standardized reading test. Hence, the findings from this study should be generalized to children and conditions with similar characteristics.

Hypotheses

Due to the limited research in this area of sight copying, the null hypotheses were used. The set of hypotheses tested are listed below.

1. There will be no significant differences in sight copying productivity between boys and girls when sight copying.
2. There will be no significant differences in accuracy between boys and girls when sight copying.
3. The level of passage difficulty will have no effect on the rate and accuracy of sight copying of boys and girls.
4. The correlations will not be significantly different from zero between the students' achievement subtest scores as measured by the Canadian Test of Basic Skills and the rate and accuracy of sight copying.

Chapter 2

SELECTED REVIEW OF THE LITERATURE

The purpose of this review is to provide the necessary background information on copying as it relates to this study. The main topics covered by this review are: (1) skills involved in copying, (2) copying speed, (3) copying accuracy, (4) sex differences in copying, and (5) the effect reading skills have on copying.

Skills Involved in Copying

There are basically two views as to what is involved in copying. One view is that it involves sensory motor or tactile-kinesthetic learning (Freeman, 1917, cited in Kirk, 1980; Williams, 1975). From this viewpoint, copying skill is the result of the development of motor practices that are perfected by further practice. The other perspective suggests that copying is a cognitive task that is governed by rules (Kirk, 1980). According to this view, what children learn is not a motor pattern, but a set of rules or strategies that enables them to copy from a model.

Townsend (1951) stated that copying of any form by children involves a combination of form perception, the comprehension of that form, and the motor skill to reproduce that form. He found that form perception was more influential in copying than motor abilities. In fact, he mentions that even if motor skills are present, they cannot be expressed in copying without adequate form perception and form comprehension.

Rand (1973) says that copying is a complex task that requires

visual analysis of component parts, recognition of the relationship between parts and the whole, and a plan of action. To copy, a child must know where to start, in what direction to move, and where to stop and change directions. Hildreth (1955) agrees that the mechanical process of putting marks on paper is not a simple reflex response but reflects the thinking processes in language development.

Thompson (1931) indicates that to copy accurately, students must recognize, visualize, or memorize the item to be copied in order to reproduce it. Comprehension is not necessary, but it does help in lengthening the recognition and memory span. She states that some students reproduce a visual memory, while others recognize, recall and dictate to themselves.

Kovitz (1982) agrees that copying is a complex task represented by a number of identified skills used either separately or simultaneously. Figure 1 shows the copying task to be a series of sequential steps demanding various skills at a precise moment.

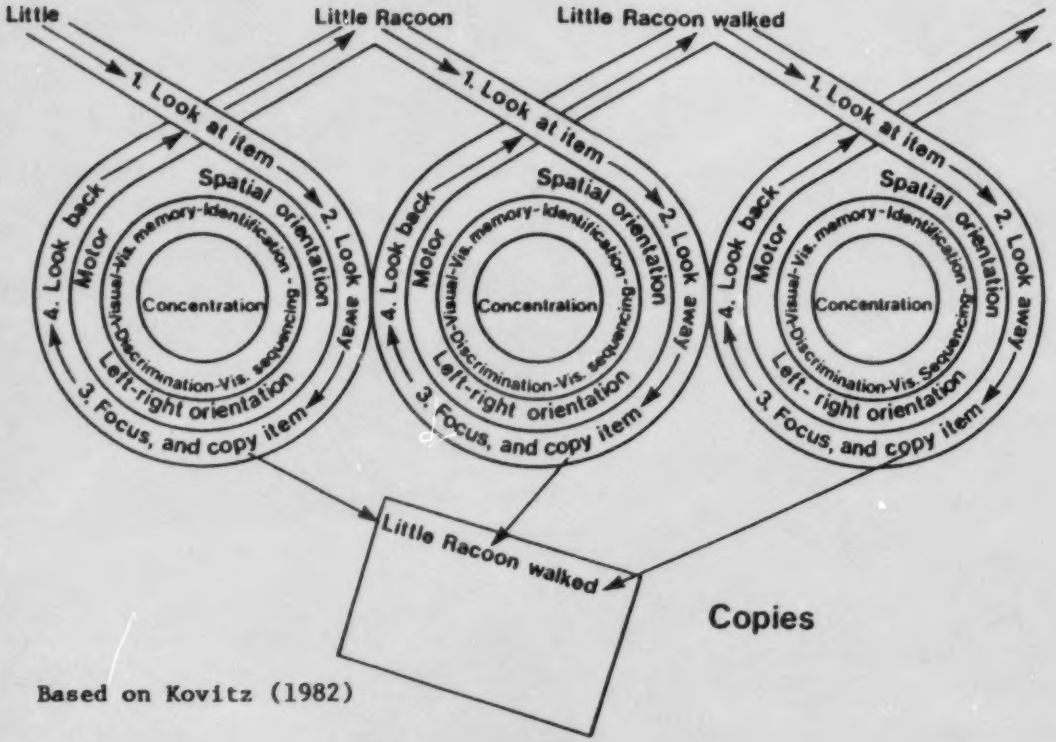
As can be seen in Figure 1, Kovitz (1982) establishes concentration as the core to making copying accurate and complete. If students lack concentration on the copying task, they will have difficulty following the methodical approach that Kovitz describes. She identifies four sequential steps involved in copying: (1) look at the item to be copied (visual); (2) look away from the item; (3) focus on the paper and reproduce the item (visual and motor); and (4) look back at the text (visual). Kovitz asserts that if copying is slow or inaccurate or both, the most likely cause is step four since a number of crucial skills converge, any one of which could affect production and accuracy. It is

Figure 1

Copying Process for Word by Word Copier

Little Racoon walked onto the tree and began to cross the pool. He was brave, but he did wish he had not seen Fat Rabbit.

Looks at item



Copies

Based on Kovitz (1982)

at step four that students must recall placement on the page within the content (visual memory) and locate the correct letter or word in the original text. This requires visual identification, discrimination, and spatial orientation. Finally, students must look to the right for the next adjacent item to be copied which includes left-right orientation and visual sequencing. As Figure 1 illustrates, the process is repeated for each subsequent letter, word, phrase, or sentence.

Kovitz (1982) states that accurate sequential copying is based on the principle of relocating the last item copied in order to identify the next item in the sequence. Although this seems quite simple, it nonetheless requires great concentration drawing on several perceptual skills simultaneously.

Speed of Copying

Researchers (Thompson, 1931 & Fillion, 1979) confirm that copying is widely used in school and life situations. Teachers expect their students to copy required material within a "reasonable" length of time. However, what is a reasonable length of time to copy a page of history notes, science notes from the blackboard, a poem, or a list of references? What are the existing speed norms for different grade levels?

Much of the information about speed of copying comes from handwriting research. Speed of handwriting is defined as "the rapidity with which the letter forms are written" (Cuthbert, 1967, p. 9). This is usually expressed as the number of written letters per minute. With the exception of Klein's (1981) exploratory study, all of the tests used in developing speed norm scales had students either read, write, or

memorize the material to be copied. The subjects then copied the studied material consisting of one to three sentences over and over for a specified amount of time. The resulting speed norms therefore do not represent true sight copying as was defined in this study representing normal daily school situations. Yet such norms may be guiding educators in deciding, at various grade levels, how long it should take students to copy boardwork, for example.

The following section reviews the literature of existing speed norms available for different grade levels. Table 2.1 shows Freeman's (1914, cited in Herrick, 1963) proposed speed norms, using a two minute memorized sample of: "The quick brown fox jumps over the lazy dog." This sentence was used since it included every letter of the alphabet at least once.

Table 2.1

Freeman's 1914 Proposed Number of Letters Per Minute Copied at Grades Two through Eight

Grade	2	3	4	5	6	7	8
Speed	36	48	56	65	72	80	90

In an article written forty years later in 1954, Freeman describes how he averaged the findings of various research studies dealing with the speed of copying resulting in the speed norm table produced below:

Table 2.2

Average Number of Letters Per Minute

For Grades Two through Eight

Grade	2	3	4	5	6	7	8
Speed	30	40	50	60	67	74	80

As can be seen, these average findings are lower, at all grade levels, than Freeman's 1914 speed norms.

Ayres (1917, cited in Groff, 1961) measured the speed of students' handwriting and has set norms which are still in use. To find the norms, he had students in grade five through eight read the first three sentences of Lincoln's "Gettysburg Address" until they were familiar with them. The sentences were then written in cursive writing on the board and the students were asked to copy the sentences until they were "familiar" with them. Finally, the students were given two minutes to copy the three sentences over and over until the end of the time limit. Speed norms were then established.

A number of objections to the procedures used by Ayres was raised by Groff (1961). His main concern was that norms were established after prior written practice on the material which is hardly what happens in normal school copying situations. As he states, "Looking to other tests, one would not likely learn that a pupil reads or practices in some way a reading, spelling or language usage test before taking the same test" (p. 283). Groff anticipated that the actual or expected

speed of students' handwriting when writing stories, reports, letters, etc. would differ greatly from the relatively artificial speed they could achieve after repeatedly copying a passage. He was also unclear as to what Ayres meant by "until the students were familiar with the passage". Groff believes that Ayres' norms, therefore, may be excessively high due to the practice effect. He decided to adjust Ayres' procedures by having 4,834 middle grade students orally read the first three sentences of the Gettysburg Address, written in manuscript on the blackboard, until they were familiar with the words. In this way, unfamiliarity in writing the sentences was assured. A two minute handwriting speed test was then administered from which norms were established. These norms are about 34% below Ayres'. Although Groff believes his norms are nearer the actual handwriting speed of students, nevertheless the students had visual familiarity with content unlike daily school situations where most material copied is seen for the first time.

Klein (1981) conducted an exploratory study to establish norms for sight copying at grades four, six, and eight. His students, unlike those of Ayres' and Groff's, had no prior exposure to the material to be copied. They were given two minutes to copy a 216 word excerpt from a story rated at the grade seven readability level.

Table 2.3 reveals the speed norms developed by Ayres (1917, cited in Groff, 1961), Groff (1961), and Klein (1981), using three different testing schemes.

Table 2.3

Average Copying Per Minute Based on Three Studies

(Adapted from Groff, 1961; Klein, 1981)

Researcher	Testing Scheme	Material Level	Letters Per Minute			
			Gr. 4	Gr. 5	Gr. 6	Gr. 8
Ayres (1917)	Memorization and Written Practice	10	55.00	64.00	71.00	*----
Groff (1969)	Oral Teaching/Learning	10	35.06	40.65	49.65	*----
Klein (1981)	No Prior Practice	7	35.74	*----	52.56	77.18

*Not tested.

Groff's and Klein's results are similar whereas Ayres' norms are about 35% to 40% higher. As noted above, Ayres' students had written practice on the material which may have caused the higher speed norms. Klein also found that each higher grade obtained a 45% greater letter output than the previous grade. Girls' letter output averaged about 20% more than the boys' across the three grades.

Furner (1969) had grade one students copy a sample for ten minutes. He found that the average first grader can write 16-17 letters per minute or 160-170 letters in 10 minutes, or about 30 words.

In 1977, the Saskatoon Roman Catholic Schools' Professional Service Department distributed to the schools a booklet called "Lessons in Handwriting". It reported that the average grade three student should be able to write at 30 letters per minute, at grade four, 40-45 letters per minute, grade five, 50-60 letters per minute, and grade six, 60-80 letters per minute. They cautioned that these speeds should be regarded

as approximate as "speed at which children can write legibly and comfortably is the only speed which has real meaning" (p. 4).

Enstrom (1964) believes that speed tests should consist of all lower-case letters as they make up 80% of all writing that is done. The statement most commonly used is: "The quick brown fox jumps over the lazy dog." He is in agreement with Ayres (1917, cited in Groff, 1961) and Groff (1961) that the students should know the sentence thoroughly before beginning the speed test. However, he states that the speed test should be equivalent to a period of note-taking which is usually 45 minutes.

Accuracy in Copying

Copying phone numbers, income tax information, mathematical quations, card catalogue numbers, numbers or letters into computers, and composition papers are only a few examples of times when accuracy in copying is very important. Although copying accurately is an important skill, little research has been done on how accurately educators should be expecting students to copy at various grade levels. As Kovitz (1982) states:

> From second grade through graduate school it is generally assumed that this skill has been mastered. . . . This hidden culprit is often unrecognized by the classroom teacher or by the student himself who may have no trouble with the actual content of a given task but whose inaccurate or incomplete copying of information can create problems. This can often be misinterpreted as laziness, carelessness or inability. (p. 83)

Klein (1981) conducted a study on sight copying involving 194 grades four, six, and eight students. He found grade six students to be the most accurate of the three grades and grade four students the

least accurate. However, the grade fours were copying a passage three grades above their grade level. It was also noted that 43% of sixth graders and 41% of eighth graders were error free in their copying performance, whereas only 15% of fourth graders were perfect copiers. Klein compared grade six and eight students' perfect papers to those with one or more errors. He found that girls with 0% errors produced about 1% less symbol output than those with one or more errors. Grade six boys with 0% errors were approximately 7% less productive than those who were not perfect copiers. In grade eight, those who made one or more errors had a 25% greater symbol output than those with perfectly copied papers.

A study by Søvik (1976) demonstrated how different types of instructions on how to copy improved the copying accuracy of poor writers. Poor writers were defined as students with a handwriting skill below the average of their grade. However, the accuracy scores of good writers were not significantly affected by the different types of instructions. Good writers were identified as students with above average handwriting skills for their grade level.

Other researchers wondered if visual discrimination training enhances a student's ability to copy accurately. Strayer and Ames (1972) found that four and five year olds who were given perceptual training in using orientation as a discrimination stimulus significantly improved in copying performance. However, Williams (1975), Hirsch and Niedmeyer (1973), and Rand (1973) found that discrimination training in geometric figures and letter formation is limited to performance on tests involving similar procedures. Therefore, the ability to

discriminate between letters and the ability to copy letters may be considered as separate skills.

Accuracy and Language Skills

Hildreth (1955) and Corcoran (1970) suggested that students should copy group compositions from the board in both the lower and upper grades. They indicated that this type of copying activity would enhance writing, composition, and spelling skills. They further claimed that copying strengthened the visual and motor impressions of words, provided the teacher with diagnostic information about the students, and provided the students with an opportunity for proofreading for correct capitalization, punctuation, correct letter forms, and word order against a correct copy. They went on to say that as students copy words and sentences, they become aware of the general appearance of words and of correct spelling. Finally they claimed that the actual muscular copying served to bring together the aural and visual stimuli for the learning process.

Accuracy and Modes of Presentation

Sloman (cited in Thompson, 1931), Corcoran (1970), and Dallman (1976) recommended that students have a separate model or piece of paper at their desks from which to copy. They felt that this would ensure a greater degree of accuracy than copying from the blackboard.

Mahoney & Schmidt (cited in Thompson, 1931) concluded that copying is best achieved from textbooks. However, textbook copying is usually a transition from print to script. Thompson (1931) found that fewer copying mistakes are made from print to print than from script to

script or print to script.

Klein (1981), whose students copied from print to script, found no differences between the overhead and the duplicated page when used as the stimulus source for sight copying.

Sex Differences and Copying

Review of the literature found that the only study that explored sex differences in copying was Klein's (1981) study. He found that, at each grade level, girls' symbol output was greater than the boys', averaging about 20% more across the three grades. According to Klein (1981), teachers can expect girls to copy about 15% more than boys in the same amount of time. He also found girls to be significantly more error free copiers than boys.

Sex differences in reading, favoring the girls, have been reported by many researchers. According to Betts (1954), girls excel in vocabulary, written composition, spelling, and speed and quality of handwriting. Durrell (1940), Gates (1961), and Dykstra and Tinney (1969) stated that girls, in the early years of schooling, are more advanced in visual skills and are generally superior in reading and spelling ability, conventions of language, and arithmetic computations. Girls' superiority over boys seems to extend into the upper grades in American schools (Gates, 1961; Dwyer, 1973; & Johnson, 1973). Girls were also found to be superior to boys when information was in the form of symbolic or semantic material, and the response required attention to detail (Maccoby & Jacklin, 1974). Tyler (1965, cited in Lloyd & Archer, 1976) and Maccoby and Jacklin (1974) reported that girls are

also better in manual dexterity involving discrete movements of the fingers and motor coordination, whereas boys excel in speed of gross motor activities.

According to Lloyd and Archer (1976), girls' and boys' eye movements are also different. Girls scan their environment with a type of eye movement highly suitable for detailed visual discrimination and visual memory. Boys' eye movements are more suited for understanding and predicting the relationships of objects in space.

Reading Ability and Copying

Corcoran (1970) and Thurber (1975) stated that the copying of letters and words in the early stages of schooling serves to coordinate and integrate the oral and visual stimuli for the learning process. According to these authors, sentence development and basic vocabulary are learned more quickly when the words are physically written down. Corcoran (1970) believed that children's copying exercises should focus on spelling, capitalization, punctuation, correct letter forms, and word order. Copying can also be used to check comprehension. Programs such as "Write Me a Ream" (Kunz & Viscount, 1973) and "Composition: Guided→Free" (Dykstra, Port & Port, 1978) used copying to enhance writing and vocabulary skills. A number of different types of exercises in various language arts programs use copying to reinforce different reading skills as was mentioned in Chapter 1.

An experiment by Vellutino and Kandel (1972) was conducted to determine if normal and poor readers who were subjected to do the same copying tasks would produce similar results. It was found that there

were no differences between the groups in the reproduction of designs and numbers. It was also concluded that normal and poor readers did not differ significantly in copying three letters at a time but there was a significant difference between the two groups in copying four and five letter stimuli favoring more accuracy for normal readers. Copying performance of both groups declined as the number of letters per word increased. The spelling of words was more deficient in poor readers than normal readers. These researchers concluded that the normal readers probably had a greater familiarity with linguistic structure of words used as compared to poor readers. Both groups copied with accuracy a significantly greater number of words than they were able to read correctly, but the poor readers' oral reading of the words copied was more often incorrect. It was concluded that reading disability is best viewed as a cognitive rather than a perceptual disorder.

Summary

This review of the literature has attempted to provide the theoretical background necessary for this study. Areas discussed were: skills involved in copying, speed and accuracy of copying, sex differences in copying, and the effects that reading abilities have on copying.

Hypotheses

Due to the limited research done on sex differences and sight copying and the fact that no previous research has been done on

difficulty level of passages and correlations of sight copying, null hypotheses were used.

1. There will be no significant difference in accuracy between boys and girls when sight copying.
2. There will be no significant differences in accuracy between boys and girls when sight copying.
3. The level of passage difficulty will have no effect on the rate and accuracy of sight copying of boys and girls.
4. The correlations will not be significantly different from zero between the students' achievement subtest scores as measured by the Canadian Test of Basic Skills and the rate and accuracy of sight copying.

Chapter 3

INVESTIGATION PROCEDURES

Chapter 3 describes the procedures used to examine the effect that levels of difficulty have on the rate and accuracy of sight copying at grades four, six, and eight, and to identify correlates related to sight copying.

The chapter is divided into four sections: (1) the sample, (2) the data gathering instruments, (3) the experimental procedures, and (4) the data analysis.

The Sample

The subjects for this study consisted of grades four, six, and eight boys and girls from two large lower middle class elementary schools selected by the Superintendent of the Separate School Board in Saskatoon during the 1979-1980 school year. The schools are approximately one mile apart. When comparing the C.T.B.S. average scores of the two schools to the system's average, there is an indication that these two schools are a sample of grades four, six, and eight students of average reading ability (Appendix A).

The total sample consisted of 76 girls and 73 boys. The number of girls and boys at each grade level that participated in this study is presented in Table 3.1.

Table 3.1

Number of Girls and Boys that Participated in the Study in Grades Four, Six, and Eight

	Grade		
Sex	4	6	8
Girls	26	26	24
Boys	25	22	26

Data Gathering Instruments

Passages

At each grade level, three passages were used--one passage two grades below students' grade level, one at their grade level, and one passage two grades above their grade level. All but two passages overlapped between grade levels while one passage was used for all three levels as is shown in Table 3.2.

Table 3.2

Passage Levels Copied at Grades Four, Six, and Eight

	Passage Levels				
Grade Placement	2	4	6	8	10
4	X	X	X		
6		X	X	X	
8			X	X	X

Selection of passages. The five passages (see Appendix C) were selected from the "Houghton Mifflin" Readers, (Durr, LePere & Brown, 1974), a series not used in Saskatchewan and likely to be unfamiliar to the students. The passages were chosen according to what was expected by the researcher to be of interest to the students at the varying grade levels. A published handout on the "Houghton Mifflin" Readers states:

> From this careful selection came a final compilation of reading selections that are of proven interest to children, that are recognized for their literary excellence, and that deal with incidents and settings to which children can relate. (p. 10)

In order to assess the appropriateness of the passages' lengths, students in grades four, six, and eight in a third school, in which the researcher teaches, were administered the passages. The passages were found to be of appropriate length so that no one could complete the copying in the allotted time, which was three minutes.

Readability. The Fry Readability Formula (Fry, 1977) was used to ensure that the passages were at the required grade levels. The Fry Readability Formula was chosen over other possible formulas because of its widespread use, its easy application and its reputation for being valid (Klare, 1974). Table 1 in Appendix B presents Fry's Readability Level for each passage as well as the number of words, sentences, syllables, letters, and punctuation marks per passage. An abbreviated table is presented below.

Table 3.3

Analysis of Passages Using Fry's Readability Formula

Grade Placement	No. of Words	No. of Sentences	No. of Syllables	Readability Level According to Fry's Formula
4	113	14	129	Grade 2
4,6	124	13	169	Grade 4
4,6,8	135	7	162	Grade 6
6,8	140	6	185	Grade 8
8	126	5	189	Grade 10

Format and booklets. The passages were typed double-spaced using pica type. The original pages were then printed professionally to insure a clear model from which the students could copy. Booklets of the three pasages at each grade level were then assembled randomly to offset order effect. Thus, for grade four, passages might have been copied in grade two, four, and six order by one student; grade four, six, and two by a second student; grade six, four, and two by a third student, and so on. The three passages at each grade level were stapled together along with a blank cover sheet which masked the first passage to be copied. After the booklets were assembled, the pages were numbered consecutively: one, two, and three. This permitted the researcher to check that each student was on the correct sequential page.

Demographic Information

A cover form for the student's name, grade, and age was also typed and printed professionally.

Additional Material Needed

Writing paper. Each student was given three sheets of 8½" x 11" lined paper with lines 17.5 cm long. On the left was a red margin of 2½ cm.

Writing instrument. Students selected their own writing instrument which was either a pen or a pencil, following the procedures used by each classroom teacher. At the time of testing, the students were told: "You may use either a pen or pencil to write with. Use the one you feel most comfortable with."

Electronic timing. Children copied for exactly three minutes. The timing was done electronically. At the end of three minutes, a buzzer sounded and a red light flashed signalling the end of copying time. The students had been instructed, when the buzzer sounded, to "lift your pen or pencil immediately from your paper. Do not try to finish a word. You are not expected to copy everything on the page in the time I am giving you." It was unnecessary to reset the timer from class to class.

Time Budget

It took exactly nine minutes of actual copying time for each grade to complete the study. However, a half hour was allotted by each classroom teacher to the study to encompass directions and other explanations as needed. Testing occurred at the two schools during the morning on successive days.

Experimental Procedures

To recapitulate, from randomly assembled printed booklets, students in grades four, six, and eight sight copied passages two grades below their grade level, at their grade level, and two grades above their grade level. A time limit of three minutes was given for copying each passage.

The following steps were used for each grade at the two schools:

1. The researcher briefly explained the purpose of her visit to the school. As well, the students were told:

   What you do for me this morning will not affect your school marks in any way, but it is important for the results of my study that you try to do your best.

2. Students were then told:

   You may use either a pen or pencil to write with. Use the one you feel most comfortable with.

3. Each student first completed the cover form which was explained by the researcher. The cover was placed in the corner of each desk.

4. Three pieces of lined paper were passed out to each student. On each page students wrote their name in the corner. After identifying themselves, one page was placed in the normal writing position and the remaining pages were placed away from them.

5. The following instructions were given by the researcher while holding up a sample copy booklet:

   In a few minutes I am going to give you a three-page booklet. On each page, part of a story is typed. For each page I want to see how much of the story you can copy in three minutes. Keep your booklets closed until I ask you to open them. Do not page through them when they are handed out.

6. After the booklets were handed out, the children were told:

   Open your booklets to page one. When I say 'Begin,' start copying exactly what is on the page onto the piece of paper that is in front of you. Copy as much of the story as you can, but write so that someone other than yourself can read what you have written. When the buzzer on the electrical timer sounds at the end of three minutes, stop. Do not try to finish a word. You are not expected to copy everything on the page in the time I am giving you. Are there any questions?

7. At the end of three minutes, the researcher said:

   Put your sheet of paper that you have written on to the side of your desk. Take a second piece of paper to copy on. Turn to page two of your booklet and then look at me.

8. Part of Step 6 instructions were repeated for the next two passages.

9. At the end of the last copied passage, the students were asked to put the cover form on top and then the sheets of paper they had written on so that the sheets could be stapled together. The papers were then collected.

10. The students were then thanked for their cooperation.

Scoring Procedures

The students' copied passages were marked by the researcher adhering strictly to the requirements outlined in a scoring key (Appendix D). Each paper received two scores--one for productivity and one for error.

The rate of productivity of copying was calculated by counting all written symbols on the paper, whether correctly or incorrectly copied. This included deviations from the original model such as additional letters, reversals, repeated words, or new words. Each symbol was given

a value of one. The number of symbols on the paper divided by three gave a rate or productivity per minute score.

Errors were marked by circling or noting with a caret all deviations from the original model. This included omissions, crossouts, additions, punctuation errors, and the like. An error rate score was obtained.

The following is an example of how one grade four student's paper was marked:

A gruff voice demanded Tony's pass. Then he was pushed along in a slow stream of tall people up into the high bleachers. The baseball diamond looked far away, especially the outfield.

Errors - 6

Rate - 149

Treatment of Data

This study sought answers to the following questions:

1. Are there significant sex differences according to the rate and accuracy of sight copying?
2. Does the level of difficulty of passages to be copied significantly affect the rate and accuracy of sight copying?
3. How does the rate and accuracy of sight copying correlate with students' reading, spelling, language, and mathematical scores as measured by the Canadian Test of Basic Skills administered to the students in the 1979-1980 school year?

Analysis of variance and covariance including repeated measures using the Biomedical Computer Program P2V (Engleman, Frane & Jennrich,

1977) assessed the significance of differences among groups in productivity and error rate at three levels of difficulty for grades four, six, and eight students. One way analysis of variance using the Student Newman-Keuls method of pairwise comparisons was used to indicate which levels of difficulty were causing significant differences. The correlations between productivity and error rate of students in grades four, six, and eight and their C.T.B.S. subtest scores were analyzed with Pearson correlations by using subprograms from the Statistical Packages for the Social Sciences (Nie, Hall, Jenkins, Steinbrenner & Brent, 1975).

The null hypotheses were rejected when a .05 level of confidence was reached.

Chapter 4

RESULTS

The purpose of this study was to analyze the effect that different levels of difficulty have on the rate and accuracy of sight copying and to explore variances of correlates which may be related to sight copying. The sample of 149 grades four, six, and eight students sight copied passages that were rated, according to Fry's Readability Formula, as two grades below grade level, at grade level, and two grades above grade level. Each passage was copied for exactly three minutes.

The students' copied passages were marked by the researcher who adhered strictly to the scoring protocals as outlined in Appendix D. Each paper received a productivity and an error rate score. Analyses of variance and covariance including repeated measures were used to determine the significance of difference. The Student Newman-Keuls method of pairwise comparisons computed which of the three difficulty levels was causing the significant differences in productivity and error rate. Subprograms from the Statistical Package for the Social Sciences (1975) analyzed the correlation between productivity and error rate and the students' C.T.B.S. subtest scores.

Productivity

Productivity scores of boys and girls in grades four, six, and eight who sight copied passages at three different levels of difficulty were analyzed.

Table 4.1 reveals that each grade had a greater written productivity score than the previous grade. Accordingly, grade six had a symbol

output 52.6% greater than grade four, and grade eight, a 24.5% greater symbol output than grade six. The variability of scores increases for both girls and boys for each higher grade, with grade eight having the highest variability in symbol output.

Table 4.1

Mean Number of Symbols of Sight Copying in Three Minutes by Girls and Boys in Grades Four, Six, and Eight

	Grade 4		Grade 6		Grade 8	
	M	SD	M	SD	M	SD
Girls	145.90	28.25	219.40	42.16	282.71	46.69
Boys	128.49	27.29	197.97	39.30	240.67	54.64
Total	137.37	29.12	209.58	42.01	260.85	55.14

At all grade levels, girls were shown to have a greater observed productivity score than the boys. In fact, the girls were 13.5% more productive than the boys at the grade four level, 10.8% at the grade six level, and 17.5% at the grade eight level. The greatest spread of variability of scores between boys and girls occurred at grade eight (±8.05).

Productivity of Grade Four Students at Three Levels of Difficulty

Table 4.2 shows the mean productivity scores at each tested level by sex for grade four students. The productivity level of the girls was 13.5% above that of the boys' score.

Table 4.2

Mean Productivity Scores of Grade Four Students

by Sex at Three Levels of Difficulty

Difficulty Level	Girls	SD	Boys	SD	Total by Level
Below (2)	143.42	25.84	129.48	26.40	136.59
At (4)	147.12	31.07	126.20	28.55	136.86
Above (6)	147.15	27.43	129.80	26.73	138.65
Total by Sex	145.90		128.49		137.37

Sex differences favoring the girls at a significant level is further revealed in Table 4.3.

Table 4.3

Analysis of Variance for Productivity at Grade Four

Source	Sum of Square	d.f.	MS	F	P
Sex	11581.58	1	11581.58	6.25	.02
Error	90858.59	49	1854.26		
Difficulty Levels	126.67	2	63.34	0.28	.76
Sex X Diff. Level	309.84	2	154.92	0.68	.51
Error	22210.03	98	226.63		

However, difficulty of the passages does not significantly affect productivity when sight copying, nor is there a significant interaction of sex by difficulty levels.

Productivity of Grade Six Students at Three Levels of Difficulty

The mean productivity scores at each tested level by sex for grade six is identified in Table 4.4. The grade six girls' symbol output is 10.8% greater than the grade six boys' output.

Table 4.4

Mean Productivity Scores of Grade Six Students by Sex at Three Levels of Difficulty

Grade Level	Girls	SD	Boys	SD	Total by Level
Below (4)	216.73	37.39	202.68	42.80	210.20
At (6)	213.77	41.18	187.77	38.91	201.85
Above (8)	227.69	37.84	203.45	42.76	216.58
Total by Sex	219.40		197.97		209.58

However, as shown in Table 4.5, the productivity scores between the sexes do not reach a significant level ($F=3.75$; $d.f.=1$; $p=0.06$). The interaction of sex and difficulty level failed to reach a significant level as well.

Table 4.5

Analysis of Variance for Productivity at Grade Six

Source	Sum of Square	d.f.	MS	F	P
Sex	16414.54	1	16414.54	3.75	.06
Error	201311.94	46	4376.35		
Difficulty Levels	5296.97	2	2648.48	11.88	.00
Sex X Diff. Levels	991.66	2	495.83	2.22	.11
Error	20517.41	92	223.02		

Table 4.5 also reveals that the differences between the difficulty levels are significant (F=11.88; d.f.=2; p=0.000). The Student Newman-Keuls method of pairwise comparisons was used to determine which of the difficulty levels were significantly different. The differences, although significant, were so slight that when the Student Newman-Keuls test was used, no differences were found due to the relatively greater conservativism of the Newman-Keuls test than of anova.

Productivity of Grade Eight Students at Three Levels of Difficulty

As shown in Table 4.6, girls in grade eight tended to have a greater symbol output than grade eight boys. This same symbol output difference was found previously with students in grades four and six.

Table 4.6

Mean Productivity Scores of Grade Eight Students

by Sex at Three Levels of Difficulty

Difficulty Level	Girls	SD	Boys	SD	Total by Level
Below (6)	277.63	46.63	227.10	57.20	251.40
At (8)	292.29	49.42	248.77	54.62	269.66
Above (10)	278.21	42.25	246.04	49.24	261.48
Total by Sex	282.71		240.67		260.85

Grade eight girls achieved a 17.5% higher symbol productivity score than the grade eight boys.

Table 4.7 demonstrates that the sex of the students and the difficulty of the passages significantly affected the symbol productivity at the grade eight level, but there was no significant interaction.

Table 4.7

Analysis of Variance for Productivity at Grade Eight

Source	Sum of Square	d.f.	MS	F	P
Sex	66175.27	1	66175.27	11.05	.002
Error	287696.21	48	5993.67		
Difficulty Levels	8211.08	2	4105.54	5.15	.008
Sex X Diff. Levels	2122.28	2	1061.14	1.33	.269
Error	76551.95	96	797.42		

The Student Newman-Keuls method of pairwise comparisons was used to analyze which levels of difficulty were causing the significant difference. This test revealed, as in grade six, no significant differences between the levels due to the differences being so slight.

Error Rate

The following tables indicate the mean error rate scores that were obtained by students in grades four, six, and eight.

As shown in Table 4.8, each grade had a greater accuracy score than the previous grade. Accordingly, grade six students had a 59.6% lower error rate than grade four students, and grade eight students had a 21.4% lower error rate than grade six students.

Table 4.8

Mean Error Rate of Sight Copying in Three Minutes of Girls and Boys in Grades Four, Six, and Eight

	Grade 4	Grade 6	Grade 8
Girls	0.077	0.042	0.029
Boys	0.088	0.064	0.056
Total	0.083	0.052	0.043

At all grade levels, girls had a lower error score than the boys and this difference increased as the grades increased. Thus, girls in grades four, six, and eight had 12.5%, 34.4%, and 48.2% respectively lower error rates than the boys.

The grades varied as to which passages caused the least accurate copies. Grade four students were least accurate when the material to be copied was below grade level, whereas grade six students were least accurate copying material at grade level. Passages copied below and above grade level for grade eight students produced the same accuracy score.

Error Rate of Grade Four Students at Three Levels of Difficulty

Results from Table 4.9 show that, in grade four, the girls had a lower mean error rate than the boys except when the material was below grade level. However, this difference failed to reach the .05 level of significance (F=0.26; d.f.=1; p=0.61) as shown in Table 4.10.

Table 4.9

Mean Error Rate Scores of Grade Four Students

by Sex at Three Levels of Difficulty

Difficulty Level	Girls	SD	Boys	SD	Total by Level
Below (2)	.12	.08	.11	.12	.11
At (4)	.06	.05	.07	.09	.06
Above (6)	.06	.07	.08	.18	.07
Total by Sex	.08		.08		

Table 4.10

Analysis of Variance for Error Rate at Grade Four

Source	Sum of Square	d.f.	MS	F	P
Sex	.01	1	.01	.26	.61
Error	0.95760	49	0.01954		
Difficulty Levels	.07	2	.04	4.90	.01
Sex by Diff. Levels	.01	2	.003	.45	.64
Error	0.70736	98	0.00722		

Table 4.10 reveals the rate of making errors is significantly related to difficulty, but not to sex, and the interaction of sex and difficulty levels is not significant. The Student Newman-Keuls method of pairwise comparisons was used to see which passages caused the significant differences. The test results indicated no significant differences between the passage copied as the differences were so slight.

Error Rate of Grade Six Students at Three Levels of Difficulty

Table 4.11 demonstrates that girls in grade six had slightly lower error rates than boys, but the differences were not significant ($F=3.86$; d.f.=1; $p=.06$).

Table 4.11

Mean Error Rate Scores of Grade Six Students

by Sex at Three Levels of Difficulty

Difficulty Level	Girls	SD	Boys	SD	Total by Level
Below (4)	.04	.03	.04	.04	.04
At (6)	.06	.08	.07	.08	.06
Above (8)	.03	.02	.09	.09	.06
Total by Sex	.04		.06		.05

Table 4.12

Analysis of Variance for Error Rate at Grade Six

Source	Sum of Square	d.f.	MS	F	P
Sex	.02	1	.02	3.86	.06
Error	0.21180	46	0.00460		
Difficulty Levels	.02	2	.01	2.39	.10
Sex X Diff. Levels	.02	2	.01	3.21	.045
Error	0.31230	92	0.00339		

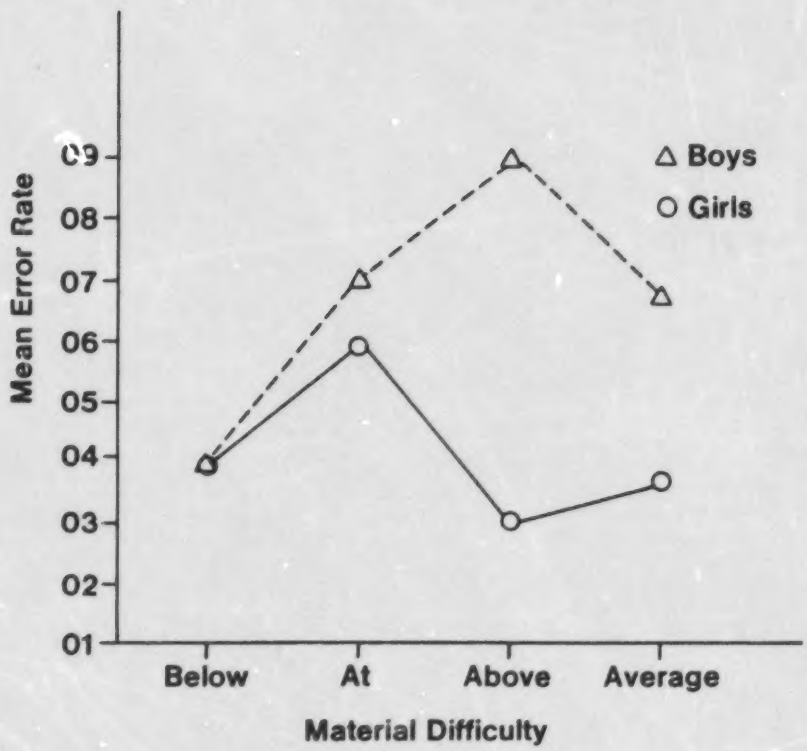
The analysis of variance for error rate for grade six students presented in Table 4.12 indicates that difficulty as well as sex are not significant factors in sight copying. However, the interaction

of sex and difficulty of passages copied is significant. (F=3.21; d.f.=2; p=.045).

From Figure 2, it was observed that girls were more error free copiers on materials above their grade level than at or below their grade level, whereas boys made increasingly more errors as the difficulty of the passages increased. Material copied at grade level produced the most copying errors for the girls.

Figure 2

Mean Error Rate Scores of Grade Six Boys and Girls at Three Levels of Difficulty



Both the girls and boys made equal rates of errors when copying the passage below their grade level. Figure 2 also reveals that, when the mean error rate scores are averaged for each sex, the girls are more accurate copiers than boys.

Error Rate of Grade Eight Students at Three Levels of Difficulty

The mean error rate of grade eight students at three levels of difficulty is shown in Table 4.13. It was found that sex differences failed to reach a significant level of .05 (F=1.80; d.f.=1; p=.17).

Table 4.13

Mean Error Rate of Grade Eight Students by Sex at Three Levels of Difficulty

Difficulty Level	Girls	SD	Boys	SD	Total by Level
Below (6)	.02	.02	.07	.12	.04
At (8)	.05	.07	.04	.04	.04
Above (10)	.02	.04	.06	.19	.04
Total by Sex	.03		.06		.04

Table 4.14

Analysis of Variance for Error Rate at Grade Eight

Source	Sum of Square	d.f.	MS	F	P
Sex	.03	1	.03	1.80	.17
Error	0.74913	48	0.01561		
Difficulty Levels	.00	2	.00	.00	1.00
Sex X Diff. Levels	.02	2	.01	1.58	.21
Error	0.70999	96	0.00740		

Difficulty level of the passages copied and the interaction of sex by difficulty levels failed to reach a significant level as well.

A comparison of mean productivity and mean error rate scores for grades four, six, and eight levels using grade six as the common copied passage is shown in Table 4.15.

Table 4.15

Mean Productivity and Error Rate of Grades

Four, Six, and Eight Students at Grade Six Level of Difficulty

	Mean Productivity		Mean Error Rate	
	Girls	Boys	Girls	Boys
Gr. 4	147.15	129.80	.06	.08
Gr. 6	213.77	187.77	.06	.07
Gr. 8	277.63	227.19	.02	.07

Table 4.15 further exemplifies that each higher grade achieved a greater symbol output than the previous grade. Girls, at each grade level, were more productive than boys. As was noted earlier, difficulty level of the copied passages does not significantly affect accuracy in copying. It was observed that girls were slightly more accurate copiers than boys.

Summary

Table 4.16 summarizes the significant and non-significant results for productivity and error rate of sight copying at the grades four, six, and eight levels.

Table 4.16

Significant and Non-Significant Probabilities of Productivity and Error Rates of Three Minutes of Sight Copying at Grades Four, Six, and Eight Levels

	Productivity			Error Rate		
Placement	Sex	Difficulty Level	Interaction	Sex	Difficulty Level	Interaction
4	.02*	.76	.51	.61	.01*	.64
6	.06	.00*	.11	.06	.10	.045*
8	.002*	.008*	.27	.17	1.00	.21

* = Significant differences at .05 level of confidence.

Sex as a significant factor in production at the grade four and eight level is revealed in Table 4.16. Difficulty level was also a

significant factor in production at the grades six and eight levels. However, further analysis using the Student Newman-Keuls test revealed no significant differences. Error rate was significantly affected by difficulty level at grade four. There was a significant interaction of sex and difficulty level for error rate at the grade six level.

Correlations of Productivity and C.T.B.S. Subtest Scores at Grades Four, Six, and Eight

As shown in Table 4.17, the significant correlations of productivity and C.T.B.S. subtest scores at the grades four and six levels are minimal. In fact, at the grade four level, vocabulary is negatively correlated to productivity when the passages were at and above grade level. No other consistent pattern followed at grade four.

Significant positive correlations were found on the Spelling and Mathematics problem solving subtests at all difficulty levels at grade six.

Table 4.17

Correlations of Productivity and C.T.B.S. Subtest Scores

at Grades Four, Six, and Eight

Grades	Levels	Voc.*	Reading	L1	L2	L3	L4	M1	M2
4	Below	-0.21	-0.09	0.15	0.36**	0.11	0.05	0.16	0.24*
	At	-0.34**	-0.14	0.06	0.12	0.04	0.03	-.007	0.10
	Above	-0.34**	-0.14	0.13	0.06	0.09	0.02	0.03	0.07
6	Below	0.06	0.08	0.28*	0.06	-0.03	-0.02	0.14	0.28*
	At	0.14	0.16	0.27*	-0.004	-0.04	-0.02	0.14	0.30*
	Above	0.08	0.11	0.29*	0.04	-0.04	-0.03	0.14	0.28*
8	Below	0.17	0.26*	0.26*	0.19	0.33**	0.21	0.27*	0.24*
	At	0.29*	0.40**	0.52***	0.42***	0.48***	0.38**	0.39**	0.32**
	Above	0.25*	0.32**	0.40**	0.30*	0.40**	0.26*	0.31*	0.28*

* <.05
** <.01
*** <.001

* Vocabulary
Reading Comprehension
Spelling
Capitalization
Punctuation
Usage
Mathematics Concepts
Mathematics Problem Solving

At grade eight, there were significant positive correlations between all of the C.T.B.S. subtest scores and sight copying at all difficulty levels with one exception. The copied passage below their grade level did not show significant positive correlations with the vocabulary, capitalization, and usage subtests.

Correlations of Error Rate and C.T.B.S. Subtest Scores at Grades Four, Six, and Eight

The correlations between error rate and C.T.B.S. subtest scores at the grades four and six levels are very slight as shown in Table 4.18. For the passage copied at grade level, only the spelling and usage subtest scores at grade four showed a significant level of negative correlation. At grade six, mathematics problem solving negatively correlated with error rate for the below grade level copied passage.

At grade eight, there were significant negative correlations between error rate and all of the C.T.B.S. subtest scores on passages copied below and above grade level. No significant correlations were found for material copied at grade level.

Table 4.18

Correlations of Error Rate and C.T.B.S. Subtest Scores

at Grades Four, Six, and Eight

Grades	Levels	Voc.*	Reading Compre.	L1	L2	L3	L4	M1	M2
4	Below	-0.033	-0.15	-0.00	-0.02	-0.20	-0.10	-0.02	-0.01
	At	-0.11	-0.17	-0.29*	-0.11	-0.16	-0.32**	-0.14	-0.14
	Above	-0.11	-0.16	-0.21	-0.06	-0.12	-0.22	-0.01	-0.02
6	Below	-0.16	-0.13	-0.24	-0.00	-0.09	-0.13	-0.22	-0.24*
	At	0.13	0.04	-0.05	0.18	0.18	0.20	0.10	-0.03
	Above	-0.17	-0.01	-0.04	-0.12	0.02	0.04	0.00	0.05
8	Below	-0.29*	-0.41**	-0.29*	-0.31*	-0.41***	-0.25*	-0.40**	-0.41**
	At	-0.002	-0.14	-0.08	-0.08	-0.03	-0.06	-0.06	-0.08
	Above	-0.60***	-0.79***	-0.57***	-0.61***	-0.60***	-0.56***	-0.59***	-0.57***

* <.05
** <.01
*** <.001

* Vocabulary
Reading Comprehension
Spelling
Capitalization
Punctuation
Usage
Mathematics Concepts
Mathematics Problem Solving

Summary

The correlations between productivity and C.T.B.S. subtest scores at the grades four and six levels are minimal. At the grade eight level, there were significant positive correlations between all of the C.T.B.S. subtest scores and sight copying at all difficulty levels with one exception. The below grade level copied passage failed to show significant

correlations with the vocabulary, capitalization, and usage subtests. The correlations between C.T.B.S. subtest scores and error rate are very slight at the grades four and six levels. At grade eight, significant negative correlations were found between all C.T.B.S. subtests and passages copied below and above grade level. No significant correlations were found for the passage copied at grade level.

Overall Summary

The purpose of this study was to analyze the effect different levels of difficulty have on the rate and accuracy of sight copying. Correlations between C.T.B.S. subtest scores and productivity and error rate scores were also analyzed.

The sample consisted of 149 grades four, six, and eight English speaking, Canadian, urban students of average reading ability. The students sight copied passages two grades below their grade level, at their grade level, and two grades above their grade level. Three minutes of copying time were allotted for each passage. Each copied passage received a productivity and error rate score.

Analysis of variance and covariance including repeated measures was used to analyze the effect different levels of difficulty of copied passages have on the rate and accuracy of sight copying. The Student Newman-Keuls method of pairwise comparisons computed which of the three difficulty levels were causing the significant differences in productivity at the grades six and eight levels and the significant differences in error rate at the grade four level. The correlations

between productivity and error rate and the students' C.T.B.S. subtest scores were analyzed using subprograms from the Statistical Package for the Social Sciences (1975).

Chapter 5

FINDINGS AND CONCLUSIONS

Summary

The purpose of this study was to analyze the effect sex and difficulty levels have on the productivity and accuracy of sight copying of students in grades four, six, and eight. The study also identified relationships between reading and mathematical skills using the C.T.B.S. subtest scores and the productivity and accuracy scores of sight copying.

To assess productivity and accuracy, students copied at sight three passages at three difficulty levels--at grade placement, two grades below, and two grades above. Each passage was copied for three minutes. A productivity and accuracy score were obtained for each passage. The two scores were compared by grade, sex, and difficulty level. Correlations of the students' productivity and accuracy scores with their C.T.B.S. subtest scores were obtained.

One hundred and forty-nine grades four, six, and eight girls and boys from two large lower middle class elementary schools in Saskatoon during the 1979-1980 school year participated in the study. At each grade level, the students' C.T.B.S. scores fell in the average range as compared to the school system's scores.

Results

Productivity of Sight Copying

1. Girls were significantly more productive than boys at grades four and eight. The difference in productivity between the sexes for

grade six failed to reach the appropriate level of significance.

2. Each higher grade achieved a greater symbol productivity than the previous grade.

Accuracy of Sight Copying

1. Trends at all grade levels revealed that girls had a lower error rate than boys, but the differences failed to reach a significant level.

2. Each higher grade had a greater accuracy score than the previous grade.

The Effect of Difficulty Levels on Productivity and Accuracy of Sight Copying

1. The estimated levels of passage difficulty for the experimental passages effects productivity and accuracy scores in a random manner.

2. The interaction of sex by difficulty level is significant at grade six for accuracy of sight copying.

Correlations of Productivity and C.T.B.S. Subtest Scores

1. At grade four, correlations of reading, language, and mathematics with productivity of copying are, at best, minimal, with only 17% of the subtest scores reaching an acceptable level of significance, and those lacked a consistent pattern.

2. At grade six, the Spelling and Mathematics Problem Solving subtests showed significant positive correlations with productivity of sight copying. No other significant correlations were found at this level.

3. At the grade eight level, 88% of the subtests showed significant positive correlations with productivity of sight copying. Vocabulary, capitalization, and usage subtests failed to indicate significant correlations with productivity when the passage copied was below grade level.

Correlations of Error Rate and C.T.B.S. Subtest Scores

1. At the grades four and six levels, minimal significant negative correlations of 8% and 4% respectively were found between C.T.B.S. subtest scores and error rate of sight copying.

2. At grade eight, 67% of the C.T.B.S. subtest scores showed significant negative correlations with error rate. However, correlations for the at grade level passage failed to reach an appropriate level of significance.

Discussion of Findings

Productivity of Sight Copying

The girls' mean productivity scores were consistently higher than the boys' productivity scores, averaging about 12% across the three grades. Although the trend was consistent, productivity failed to reach a significant level at grade six ($p=.06$). Therefore, hypothesis one, which states that there will be no significant differences between boys' and girls' productivity is rejected for grades four and eight. It is accepted for grade six since sex failed to be a significant factor in productivity at this level.

Klein (1981), who was the only researcher to look directly at sex

differences and sight copying, found girls to be superior copiers also, averaging about 20% across the three grades. The finding that girls are superior copiers to boys tends to be supported by research done on sex differences indicating that girls are better in activities involving fine motor coordination (Tyler, 1965, cited in Lloyd & Archer, 1976; Maccoby & Jacklin, 1974). Thirty years ago, Betts (1954) also noted that girls' vocabulary, spelling, written composition, and speed and quality of handwriting tend to be superior to boys'.

Differences between productivity and grade levels were most apparent in this study. Each higher grade had a greater written productivity score than the previous grade. This trend concurs with related research (Freeman, 1914, cited in Herrick, 1963; Ayres, 1917, cited in Groff, 1961; Groff, 1961; Klein, 1981). Even though each grade's productivity was greater than that of the previous grade, both Klein (1981) and this experimenter, as one might expect in individual differences, found that some fourth graders copied as fast as some sixth and eighth graders, while many sixth graders copied faster than many eighth graders.

Table 5.1 more explicitly demonstrates growth in average copying productivity from grade to grade, of girls and boys combined, written in three minutes. Shown is the average productivity of each of the grades four, six, and eight groups, all of whom copied the grade six passage. Grade four children achieved the highest productivity at this level whereas for the grade six and eight levels, productivity was the lowest.

Table 5.1

Average Symbol Productivity of Grades Four, Six, and Eight Girls and Boys Copying Grade Six Passage for Three Minutes

Grade 4 (139 Symbols)	Grade 6 (202 Symbols)	Grade 8 (251 Symbols)
He was a round little man with a red face and a whole box of tools with dials and wires. He smiled at Margie, gave her an apple, and then took the teacher apart. Margie had ho	He was a round little man with a red face and a whole box of tools with dials and wires. He smiled at Margie, gave her an apple, and then took the teacher apart. Margie had hoped he wouldn't know how to put it together again, but he knew how alright. A	He was a round little man with a red face and a whole box of tools with dials and wires. He smiled at Margie, gave her an apple, and then took the teacher apart. Margie had hoped he wouldn't know how to put it together again, but he knew alright. After an hour or so, there it was again, large and square and u

Comparing the average symbol production of each grade in Table 5.1 to the total passage length of 537 symbols indicates that grade four students were able to copy 26% of the total passage; grade six students 38%; and grade eight students 47%. Therefore, in order to copy the entire passage of 537 symbols, teachers might expect an average grade four student to take approximately 12 minutes; an average grade six student to take approximately eight minutes; and an average grade eight student to take approximately six minutes.

As was discussed in Chapter 2, several speed norm scales are in existence which could be used in guiding teachers in their expectations as to how productive students at various grade levels should be.

Table 5.2 shows a comparison between Freeman's (1914, cited in Herrick, 1963), Ayres' (1917, cited in Groff, 1961), Klein's (1981), and this researcher's (1983) speed norms using different testing schemes. In order to be consistent with previously developed speed norm scales, the table is based on one minute of copying time.

As noted earlier in Chapter 2, Freeman's and Ayres' testing involved memorization, whereas Groff's involved oral teaching/learning. Klein's and this experimenter's testing entailed no prior exposure to copied material. Although Klein and this experimenter employed the same testing scheme, variation in symbol output exists. One explanation of this variation could be due to different passage content. Specifically, Klein's passage, a short story about a girl, began with an unfamiliar name and used quotation marks which could have slowed his subjects down, compared to the narrative passages used by the experimenter.

Since Groff's (1961), Klein (1981), and this experimenter's (1983) testing schemes involved copying procedures similar to daily school situations, it is recommended that teachers average the above researchers' findings to estimate how long a copying episode may take. For example, in one minute teachers can expect grade four students to copy approximately 39 symbols or 13 words; grade six students approximately 57 symbols or 18 words; and grade eight students about 82 symbols or 24 words.

Table 5.2

Average Copying Per Minute Based on Five Studies

(Freeman, 1914; Ayres, 1917; Groff, 1961; Klein, 1981; Polanik, 1983)

Researcher	Testing Scheme	Material Level	Symbols Per Minute Gr. 4	Gr. 5	Gr. 6	Gr. 8
Freeman (1914)	Memorization (Single Passage)	-	56.00	65.00	72.00	90.00
Ayres (1917)	Memorization (Single Passage)	10	55.00	64.00	71.00	**
Groff (1961)	Oral Teaching/Learning (Single Passage)	10	35.06	40.65	49.65	**
Klein (1981)	No Prior Practice (Single Passage)	7	35.74	**	52.56	77.18
Polanik (1983)	No Prior Practice (Three Passages)	*	45.79	**	69.86	86.95

* Two grades below grade level, at grade level, and two grades above grade level.

** Not tested.

Consider the Social Studies teacher who writes two blackboards full of notes for the students to copy or the Composition teacher who asks her students to recopy a paper they have written. How long should it take students to copy the notes? According to this study, given a 2,000 symbol passage or about 516 words to copy, it should take approximately 51 minutes for average grade four students to copy the passage; approximately 35 minutes for average grade six sutdents; and approximately 24 minutes for average grade eight students. Knowing the copying time involved, teachers need to consider what is gained by hand copying, or, in effect, would a xerox copy serve the child better?

Accuracy of Sight Copying

At all grade levels, girls achieved a lower observed error rate than boys but the difference failed to reach the accepted level of significance. Therefore, hypothesis two, which states that there will be no significant differences in accuracy between the sexes, can be accepted at all three grade levels tested. Klein (1981) also found girls to be more error free copiers than boys, but unlike this experimenter's findings, his sex differences reached a significant level.

Possible explanations for the differences in accuracy of copying favoring the girls are derived from research. Research on sex differences have found that girls are more advanced in visual and fine motor skills and are generally superior in reading and spelling ability, and conventions of language than boys (Durrell, 1940; Gates, 1961; Dykstra & Tinney, 1969; Lloyd & Archer, 1976).

The Effect of Difficulty Levels on Productivity and Accuracy of Sight Copying

The three difficulty levels of the copied passages had a nebulous effect on both productivity and accuracy. Since there were no significant differences between the difficulty levels of copied passages and the productivity and accuracy scores, hypothesis three, which states that the level of difficulty of copied passages will have no effect on the productivity and accuracy of sight copying, can be accepted.

As Table 5.3 shows, difficulty level of copied passages had a random effect on productivity. Accuracy was also unaffected by difficulty level of copied passages.

Table 5.3

Productivity and Accuracy Levels of Grades Four, Six, and Eight Students by Lowest, Average, and Highest Productivity or Accuracy

	Productivity			Accuracy		
	Below	At	Above	Below	At	Above
Grade 4	Lowest	Average	Highest	Lowest	Highest	Average
Grade 6	Average	Lowest	Highest	Highest	*	*
Grade 8	Lowest	Highest	Average	*	*	*

*Same scores obtained.

There was a significant interaction of sex and difficulty level for accuracy at grade six. Difficulty level did not seem to affect the girls' accuracy, but it affected the boys'. The more difficult in readability the passages became, the higher the boys' error rate.

Correlations of Sight Copying

Minimal significant correlations between C.T.B.S. reading, language, and mathematics subtest scores and productivity and accuracy scores were found at grades four and six levels, with no consistent pattern at grade four. However, spelling and mathematics problem solving subtests showed a significant positive correlation in productivity at the grade six level. Significant positive correlations were indicated between the majority of C.T.B.S. subtests at grade eight for productivity. At grade eight, significant negative correlations were found on passages copied below and above the students' grade level

for error rate. However, no correlations for error rate were found when the copied material was at grade level in difficulty. It is almost impossible to speculate why all correlations below and above grade level were significant while none were significant at grade level.

Therefore hypothesis four, which states that the correlations will not be significantly different from zero between the students' C.T.B.S. subtest scores and the rate and accuracy of sight copying, is accepted for the majority of grades four and six C.T.B.S. subtest scores. At the grade eight level, it is rejected for productivity for most of the C.T.B.S. subtest scores and for accuracy, with the exception of when copied material was at grade level.

It would seem that only when students reach grade eight, is copying affected by their academic progress as assessed by a standardized test. At this level, the better the students are in reading, language, and mathematical ability, the more productive and accurate copier they tend to be. Perhaps, for the more mature students in this experiment, the cognitive functionings come together at this age causing them to copy more quickly and accurately. Perhaps at earlier grades, copying is almost mechanical and without thought as Fillion (1979) declares.

Implications

The results of this study add to the literature in the limited area of sight copying. The study confirms that sex differences exist and that, with age, copying is both more productive and accurate. It demonstrates that readability has little or no effect on sight copying. Finally, identifying the correlates of sight copying is indecisive.

With the preceding in mind, the following can be generalized to teachers:

1. Through the development of a new set of speed norms for sight copying at the grades four, six, and eight levels, teachers will have more realistic guidelines as to how fast students should be able to sight copy in a specified amount of time.

2. According to the results of this study, girls were more productive copiers than boys at all grade levels, although it failed to reach a significant level at grade six ($p=.06$). Adding to insights on sex differences, teachers in the classroom can expect girls to finish first in copying episodes, averaging about 12% more in productivity than boys in the same amount of time.

3. As well, teachers can expect girls to be somewhat more accurate copiers than boys, although it may not be a noticeable level in the classroom.

4. Teachers can anticipate that each grade will be more productive and accurate than the previous grade.

5. For the purpose of copying, teachers generally need not be overly concerned about presenting difficult passages for the students to copy.

Recommendations for Further Research

In light of the above, the following are suggestions for further research.

1. This study could be replicated with a larger sample. This would enable the researcher to confirm or adjust the speed norms identified in this study at these grade levels.

2. Most speed tests involve two or three minutes of copying time. As Enstrom (1964) states, a speed test should equal the normal length of a classroom period of note-taking. Future research should compare the two or three minute productivity results mentioned earlier in this study to varying lengths of copying time up to 40 minutes to determine optimum experimental copying time.

3. If the students were instructed to specifically write for speed or for accuracy, would this have affected their productivity and/or accuracy scores? Future research should compare the different sets of instructions to see if similar results would be obtained.

4. Different modes of presentation such as blackboard versus overhead versus page should be compared in future studies to assess the effect on productivity and accuracy.

5. How does copying an unfamiliar language such as Spanish as compared to English affect productivity and accuracy of sight copying? This comparison would help evaluate the role of comprehension as an important factor in copying.

6. Fillion (1979) implies that copying is a mindless act. Research should investigate what is understood following a copying episode. This could be done by checking comprehension at the end of a copying session and comparing it to comprehension after reading a passage at various levels of reading ability.

7. Programs such as "Breakthrough to Literacy" (Mackay, Thompson & Schaub, 1973) and "Write Me a Ream" (Kunz & Viscount, 1973) use copying to develop written language skills. Research is needed to see if students

could learn to write a foreign language using their copying abilities as outlined in the above programs.

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APPENDIX A

A Comparison of C.T.B.S. Subtest
Average Scores of School A and
School B at Grades Four, Six, and Eight

A Comparison of C.T.B.S. Subtest Average Scores of School A and School B

at Grades Four, Six, and Eight

	V		R		L1		L2		L3		L4		M1		M2		LTot		MTot	
GRADE 4	S	SY	S	SY	S	SY	S	SY	S	SY	S	SY	S	SY	S	SY	S	SY	S	SY
School A	5.2	5.2	5.4	5.1	5.9	5.7	5.8	5.7	6.0	5.4	5.3	5.4	5.3	5.1	5.3	5.0	5.8	5.3	5.3	5.0
School B	5.3	5.2	5.0	5.1	5.2	5.7	4.8	5.7	5.2	5.4	4.5	5.4	4.6	5.1	4.6	5.0	4.9	5.3	4.6	5.0
Average	5.3	5.2	5.2	5.1	5.6	5.7	5.3	5.7	5.6	5.4	4.9	5.4	4.9	5.1	5.0	5.0	5.4	5.3	5.0	5.0
GRADE 6																				
School A	7.2	7.2	6.9	7.3	7.4	7.4	7.5	7.2	7.4	7.4	6.9	7.3	7.7	7.6	7.1	7.1	7.3	7.3	7.3	7.3
School B	6.9	7.2	6.9	7.3	7.1	7.4	6.8	7.2	7.1	7.4	6.5	7.3	7.2	7.6	6.9	7.1	6.9	7.3	7.0	7.3
Average	7.1	7.2	6.9	7.3	7.3	7.4	7.2	7.2	7.3	7.4	6.7	7.3	7.5	7.6	7.0	7.1	7.1	7.3	7.2	7.3
GRADE 8																				
School A	8.9	8.9	9.1	9.0	9.2	9.1	9.7	9.2	9.8	9.2	8.9	8.8	9.8	9.4	9.0	8.8	9.4	9.1	9.4	9.1
School B	8.7	8.9	8.8	9.0	8.7	9.1	9.1	9.2	8.9	9.2	8.3	8.8	8.9	9.4	8.5	8.8	8.8	9.1	8.7	9.1
Average	8.8	8.9	9.0	9.0	9.0	9.1	9.4	9.2	9.4	9.2	8.6	8.8	9.4	9.4	8.8	8.8	9.1	9.1	9.1	9.1

Key:
S = School's average score
SY = System's average score
V = Vocabulary
R = Reading Comprehension
L1 = Spelling
L2 = Capitalization
L3 = Punctuation
L4 = Usage
M1 = Mathematics concept
M2 = Mathematics problem solving
LTot = Language Total
MTot = Mathematics Total

APPENDIX B

Fry Readability for Copied Passages
(chart calculations includes
letters and punctuation marks)

Table 2

Fry Readability for Copied Passages Including

Number of Letters and Punctuation Marks

	Fry's Level	No. of Words	No. of Sentences	No. of Syllables	No. of Letters	No. of Punctuation Marks
Stimulus Passages	Grade 2	113	14	129	410	19
	Grade 4	124	13	169	539	18
	Grade 6	135	7	162	520	17
	Grade 8	140	6	185	596	16
	Grade 10	126	5	189	612	15

APPENDIX C

Experimental Passages

GRADE TWO PASSAGE

Little Raccoon walked onto the tree and began to cross the pool.

He was brave, but he did wish he had not seen Fat Rabbit.

He did not want to think about IT.

He did not want to think about the thing in the pond.

But he couldn't help it.

He just had to stop and look.

There was something in the pool!

There it was, in the bright moonlight, looking up at him!

Little Raccoon did not want it to know that he was afraid.

He made a face.

The thing in the pool made a face, too.

And what a mean face it was! Little Raccoon was scared. He ran away!

Durr, W. K., LePere, J. M., & Brown, R. Rainbows. Boston, Mass.: Houghton Mifflin Co., 1974.

GRADE FOUR PASSAGE

A gruff voice demanded Tony's pass. Then he was pushed along in a slow stream of tall people up into the high bleachers. The baseball diamond looked very far away, especially the outfield. Was that tall player Charlie? He couldn't tell.

Tony watched two innings. A cold lump settled in his stomach when he remembered his lost token and Chester up on the elevated station. He stood up and struggled out through the crowded row of seats. At last he found an exit. He ran all the way around the big playing field back to the elevated station. He didn't stop running until he reached the turnstile at the top of the stairs. He dropped Chester's token into the slot. It was their last.

Durr, W. K., LePere, J. M., & Brown, R. Fiesta. Boston, Mass.: Houghton Mifflin Co., 1974.

GRADE SIX PASSAGE

He was a round little man with a red face and a whole box of tools with dials and wires. He smiled at Margie, gave her an apple, and then took the teacher apart. Margie had hoped he wouldn't know how to put it together again, but he knew how, all right. After an hour or so, there it was again, large and square and ugly, with a big screen on which all the lessons were shown and the questions were asked. That wasn't so bad. The part Margie hated most was the slot where she had to put homework and test papers. She always had to write them out in a punch code they had made her learn when she was six years old, and the mechanical teacher calculated the mark in no time.

Durr, W. K., LePere, J. M., & Brown, R. Images. Boston, Mass.: Houghton Mifflin Co., 1974.

GRADE EIGHT PASSAGE

People rarely believe that a boy we knew ran all the way around a very large block in thirty seconds, hence breaking every track record in the world. Well, there is some truth to this story, but sometimes one has to lie to tell the truth, and I had better describe this event in a little more detail.

There was a pair of twins who lived in the town; their names were Paul and Pinky Posey. They looked so completely alike that at times even their parents could not tell them apart. They both had long red hair; they were identically bowlegged; they had the same floppy ears and squeaky voices and they wore the same clothes, which usually consisted of blue jeans and white T-Shirts, minus shoes. They even got warts in the same places at the same time.

Durr, W. K., LePere, J. M., & Brown, R. Diversity. Boston, Mass.: Houghton Mifflin Co., 1974.

GRADE TEN PASSAGE

Yet they were beginning to feel the remoteness of their situation, the complete and total isolation that was sometimes frightening. Max had noticed the strain first in Haverson, who was beginning to worry about things: little things like whether he was getting enough nourishment or too much exercise. Doctor Berger has assured him that all was in order, but even Berger was showing the effects of the fearfulness of prolonged flight.

In spite of being picked because of special space abilities and being trained for years in flights to the moon and Mars, a man never seemed to get used to the weird, detached feeling of complete aloneness. And now, for the first time, man was venturing beyond Earth's solar system, relying only on their instruments.

Durr, W. K., LePere, J. M., & Brown, R. Galaxies. Boston, Mass.: Houghton Mifflin Co., 1974.

APPENDIX D

Scoring Criteria

Each paper received two scores - one for productivity and one for error.

The rate or productivity of copying was calculated by counting all written symbols on the paper, whether correctly or incorrectly copied. This included deviations from the original model such as additional letters, reversals, repeated words or new words. Each symbol was given a value of one. The number of symbols in the paper divided by three gave a rate or productivity per minute score.

Errors were marked by circling or noting with a caret all deviations from the original model. This included omissions, crossouts, additions, punctuation errors, and the like. To calculate error rate, one divided the number of incorrectly copied marks by total productivity and multiplied by 100.

The following are a few examples of the scoring criteria:

Racoon - Raccoon

1 error 6 for productivity

dmanded - demanded

1 error 8 for productivity

saw - was

2 errors 3 for productivity

outfild - outfield

1 error 7 for productivity

APPENDIX E

Raw Data

KEY TO RAW DATA

A. Sex = 1. boys 2. girls

B. HND = Handedness - 1. right
2. left
3. both

C. NAT = Nationality - 1. English
2. German
3. Spanish
4. Italian
5. Manual English Sign Language
6. Cree
7. French
8. Yugoslavian

D. PB = Productivity Below
PAT = Productivity At
PAB = Productivity Above

E. EB = Errors Below
EAT = Errors At
EAB = Errors Above

F. Voc. = Vocabulary
RDG = Reading Comprehension
LG1 = Spelling
LG2 = Capitalization
LG3 = Punctuation
LG4 = Usage

M1 = Mathematics Concepts

M2 = Mathematics Problem Solving

G. ERB = Error Rate Below

ERAT = Error Rate At

ERAB = Error Rate Above

GR	SEX	HND	NAT	PB	PAT	PAB	EB	EAT	EAB	VOC	RDG	LG1	LG2	LG3	LG4	M1	M2	RB	RAT	RAB
4	2	1	1	116	110	122	8	15	11	54	49	48	29	41	11	36	45	7	14	9
4	1	1	1	144	165	150	13	2	2	53	52	68	66	65	46	56	61	9	1	1
4	1	1	1	178	171	178	13	1	3	36	52	73	55	64	59	53	61	7	1	2
4	2	1	1	168	198	193	17	13	10	59	51	56	68	59	50	60	41	10	7	5
4	2	1	2	130	183	165	10	9	2	23	37	30	48	40	39	35	31	8	5	1
4	1	1	1	162	184	143	13	7	3	38	36	48	50	51	33	40	43	8	4	2
4	1	1	1	155	144	142	4	2	6	42	48	36	44	51	45	48	43	3	1	4
4	2	1	3	114	140	136	7	7	4	49	42	57	36	58	46	26	43	6	5	3
4	2	1	4	175	154	155	12	6	18	34	34	39	54	64	26	43	37	7	4	12
4	2	1	1	99	100	103	3	1	1	65	66	61	57	61	63	47	57	3	1	1
4	2	1	1	150	132	122	13	10	2	41	41	36	57	40	41	51	41	9	8	2
4	1	2	1	123	125	139	10	16	4	49	29	51	46	35	33	32	37	8	13	3
4	1	2	1	99	85	85	5	8	1	55	41	46	39	35	35	36	43	5	9	1
4	2	1	1	153	168	151	35	7	6	36	38	43	41	29	28	40	45	23	4	4
4	2	1	1	138	137	144	7	9	2	38	46	43	54	55	47	41	57	5	7	1
4	2	2	1	148	183	159	18	7	47	49	49	59	54	64	61	54	48	12	4	30
4	1	1	1	81	86	77	4	6	7	48	50	37	44	37	31	43	29	5	7	9
4	2	2	1	121	133	197	4	10	11	27	37	36	46	42	28	35	26	3	8	6
4	1	1	1	146	142	154	5	5	6	58	57	50	57	65	54	50	57	3	4	4
4	1	1	1	137	133	126	14	4	5	54	60	48	55	47	55	51	64	10	3	4
4	2	1	1	140	155	157	20	9	6	55	58	65	46	59	61	45	48	14	6	4
4	1	1	1	117	116	134	8	5	7	51	51	48	52	53	49	50	50	7	4	5
4	2	1	1	149	142	172	21	2	31	51	45	56	62	56	50	57	61	14	1	18
4	1	1	1	143	136	136	40	2	3	50	51	56	46	56	50	57	61	28	1	2
4	1	1	1	184	147	136	42	67	121	43	44	40	46	49	33	45	46	23	46	89
4	2	1	1	162	205	178	25	8	15	53	51	53	52	44	49	40	45	15	4	8
4	1	1	1	127	95	140	11	6	5	53	46	57	55	56	54	51	50	9	6	4
4	1	1	1	138	133	156	8	6	1	44	42	64	41	55	46	40	41	6	5	1
4	1	1	1	141	132	143	14	13	9	67	63	55	55	62	61	53	50	10	10	6
4	1	1	1	114	95	107	6	9	3	53	49	50	57	67	47	56	49	5	9	3
4	2	1	1	121	104	117	31	9	6	47	49	50	57	53	43	44	39	26	9	5
4	1	1	1	94	77	105	30	9	4	57	56	53	50	61	54	60	53	32	12	4
4	2	1	1	162	164	158	8	21	3	43	51	61	50	64	45	48	67	5	13	2
4	1	2	1	97	122	115	3	2	4	58	42	39	41	53	45	38	46	3	2	3
4	1	1	1	116	119	122	7	7	1	53	60	59	59	75	59	56	57	6	6	1
4	2	1	1	160	180	173	16	45	5	34	45	39	36	42	39	35	39	10	25	3

GR	SEX	HND	NAT	PB	PAT	PAB	EB	EAT	EAB	VOC	RDG	LG1	LG2	LG3	LG4	M1	M2	RB	RAT	RAB
4	2	1	1	99	90	100	3	3	3	44	41	37	30	22	21	32	31	3	3	3
4	2	1	1	153	150	179	33	6	0	47	50	64	59	63	49	44	49	22	4	0
4	2	1	1	110	98	118	3	2	3	57	63	62	64	67	63	54	53	3	2	3
4	1	1	1	114	90	109	3	4	6	57	55	61	57	58	61	48	52	3	4	6
4	2	1	5	152	130	115	8	1	0	53	59	64	55	55	61	47	52	5	1	0
4	1	1	1	155	171	183	10	11	4	47	46	44	41	42	41	40	39	6	6	2
4	2	1	1	201	160	145	29	4	5	50	46	59	530	59	55	47	52	14	2	3
4	2	1	1	127	152	119	12	5	18	46	52	55	44	59	55	51	53	9	3	15
4	1	1	1	111	126	131	3	8	8	60	56	50	59	56	55	51	53	3	6	6
4	2	1	6	132	123	164	33	2	1	50	45	53	54	49	46	36	20	25	2	1
4	1	1	1	94	113	89	9	9	1	50	45	50	57	61	52	35	23	10	8	1
4	2	1	1	164	160	123	13	10	9	49	50	46	41	40	37	36	37	8	6	7
4	2	3	1	185	174	161	65	4	7	57	54	57	52	55	61	50	59	35	2	4
4	1	1	1	137	132	146	76	7	54	38	33	39	25	26	23	30	39	55	5	37
4	1	1	1	130	116	99	14	10	6	57	36	46	27	42	43	43	31	11	9	6
6	1	1	1	156	142	161	6	0	7	56	34	46	60	52	54	52	35	4	0	4
6	2	2	3	236	233	250	19	5	10	56	42	34	52	31	32	42	48	8	2	4
6	1	1	1	164	166	179	6	2	1	68	70	60	55	54	55	77	64	4	1	1
6	1	1	1	203	161	173	4	5	1	66	65	59	47	62	56	69	68	2	3	1
6	1	1	1	274	248	290	1	2	51	59	66	63	56	66	56	76	72	0	1	18
6	1	1	1	229	222	264	20	16	5	82	82	82	67	81	85	92	78	9	7	2
6	2	1	1	261	286	284	5	54	15	73	75	68	69	76	88	84	76	2	19	5
6	1	1	1	223	238	233	2	0	54	63	72	46	50	77	61	85	81	1	0	23
6	2	1	1	284	303	264	1	3	5	79	69	87	78	82	70	81	74	0	1	2
6	2	1	1	219	228	217	13	12	7	65	67	53	64	66	70	70	71	6	5	3
6	1	1	1	189	195	198	4	2	2	82	75	68	67	57	54	92	78	2	1	1
6	1	1	1	182	175	173	3	6	19	65	59	71	60	76	63	78	67	2	3	11
6	2	1	1	244	222	248	13	62	4	71	66	75	78	72	72	73	67	5	28	2
6	2	1	1	257	267	294	2	7	12	71	73	67	76	62	76	85	72	1	3	4
6	1	1	1	262	246	248	2	2	1	80	80	80	74	86	76	81	72	1	1	0
6	2	1	1	234	229	250	2	3	1	77	68	70	69	66	56	86	68	1	1	0
6	1	1	1	182	159	199	2	5	56	65	67	80	73	68	68	72	71	1	3	28
6	2	1	1	218	207	225	2	6	2	69	68	83	78	87	78	79	72	1	3	1
6	2	1	1	190	212	199	1	3	3	66	63	67	56	62	68	60	66	1	1	2
6	1	1	1	165	183	175	6	11	4	68	73	55	58	68	70	66	48	4	6	2
6	2	1	1	290	277	282	4	5	7	64	62	81	47	38	58	69	58	1	2	2
6	2	1	1	227	203	227	14	8	3	64	62	70	66	34	52	60	62	6	4	1
6	2	2	1	195	187	197	1	3	4	63	57	77	60	52	70	61	62	1	2	2
6	2	2	1	216	233	237	4	3	8	74	80	87	73	88	74	90	95	2	1	3
6	2	1	1	211	200	253	1	4	4	65	62	76	69	81	65	61	69	0	2	2

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GR	SEX	HND	NAT	PB	PAT	PAB	EB	EAT	EAB	VOC	RDG	LG1	LG2	LG3	LG4	M1	M2	RB	RAT	RAB
6	2	1	1	214	217	214	7	10	7	71	68	67	86	85	72	76	74	3	5	3
6	1	1	1	208	210	217	4	51	51	73	76	77	67	76	76	84	74	2	24	24
6	2	2	1	151	146	147	8	14	5	63	61	59	78	82	72	78	74	5	10	3
6	2	1	1	171	163	190	3	6	3	70	66	53	74	81	54	64	68	2	4	2
6	2	1	1	196	182	206	1	2	1	63	67	80	76	82	76	52	55	1	1	0
6	1	1	1	170	140	164	17	7	25	64	61	65	74	72	76	58	35	10	5	15
6	2	1	1	155	198	232	3	2	1	73	77	78	78	89	65	66	62	2	1	0
6	1	1	1	218	217	235	23	29	17	65	69	55	64	66	63	60	69	11	13	7
6	2	1	1	156	136	144	6	11	5	94	99	65	81	79	91	86	69	4	8	3
6	2	1	1	212	199	243	6	56	0	90	72	84	74	82	85	77	72	3	28	0
6	2	1	1	166	169	174	17	6	13	74	67	83	71	89	76	82	88	10	4	7
6	2	1	1	248	263	244	33	11	27	63	67	65	66	62	54	56	55	13	4	11
6	1	1	1	179	150	175	17	28	16	79	82	73	83	95	88	88	71	9	19	9
6	1	1	1	266	247	255	7	19	59	66	58	68	67	68	70	54	69	3	8	23
6	1	1	1	118	109	117	2	8	7	47	45	30	50	52	54	56	40	2	7	6
6	1	1	1	167	161	162	1	2	1	70	64	61	71	74	72	66	68	1	1	1
6	2	1	1	220	186	252	12	2	9	40	39	48	60	49	38	54	60	5	1	4
6	1	1	3	228	203	210	23	60	6	42	34	28	56	64	30	54	40	10	30	3
6	1	1	1	176	164	174	12	6	10	62	65	70	52	57	61	69	71	7	4	6
6	2	1	1	243	201	236	15	2	15	68	74	78	75	89	80	71	66	6	1	6
6	1	2	1	285	186	218	7	7	6	69	73	77	85	90	70	81	85	2	4	3
6	2	1	1	219	211	211	8	29	4	80	77	78	83	87	80	84	78	4	14	2
6	1	1	1	215	209	256	5	4	9	69	63	61	62	72	56	79	66	2	2	4
8	2	1	1	251	283	270	10	2	3	46	73	90	77	69	74	61	90	4	1	1
8	1	1	1	203	202	205	7	12	13	79	74	55	86	79	55	74	83	3	6	6
8	2	1	1	290	332	314	1	49	22	80	77	85	77	89	74	79	64	0	15	7
8	1	1	1	157	215	214	10	1	6	79	84	118	104	105	108	101	88	6	0	3
8	1	1	1	279	304	312	1	7	3	93	97	116	101	110	93	101	97	0	2	1
8	1	1	1	231	240	242	7	14	12	85	93	95	95	92	74	94	90	3	6	5
8	1	1	3	154	157	171	64	8	168	--	--	--	--	--	--	--	--	42	5	98
8	2	1	1	248	268	279	1	0	0	86	90	99	92	98	70	77	86	0	0	0
8	1	1	1	299	335	343	7	1	7	88	92	98	99	98	82	91	99	2	0	2
8	1	1	1	30	316	281	14	4	8	100	98	99	101	87	95	83	80	47	1	3
8	2	1	1	353	359	346	1	4	0	101	106	109	109	107	106	100	86	0	1	0
8	2	2	1	297	303	283	0	9	6	90	104	100	88	103	91	115	107	0	3	2
8	1	1	1	202	235	187	2	4	6	97	93	86	99	89	74	87	86	1	2	3
8	2	1	7	247	265	262	0	2	1	79	85	107	101	100	88	98	90	0	1	0
8	2	1	1	226	262	271	4	1	4	80	78	71	71	65	70	66	77	2	0	1
8	1	1	1	227	230	233	4	4	3	105	114	104	99	105	98	108	103	2	2	1
8	1	1	1	218	261	210	6	7	4	100	102	99	103	103	101	110	95	3	3	2

GR	SEX	HND	NAT	PB	PAT	PAB	EB	EAT	EAB	VOC	RDG	LG1	LG2	LG3	LG4	M1	M2	RB	RAT	RAB
8	2	1	1	285	289	261	1	2	0	103	105	109	125	114	108	117	111	0	1	0
8	2	1	1	222	221	186	11	19	3	100	94	88	88	98	88	83	46	5	9	2
8	1	1	3	242	188	235	17	20	12	79	69	59	79	82	60	72	92	7	11	5
8	1	1	1	202	237	200	4	15	7	75	71	65	71	49	65	72	68	2	6	4
8	2	1	1	228	276	244	4	1	2	75	75	68	90	85	70	72	68	2	0	1
8	1	1	1	215	214	191	5	2	4	88	92	78	68	69	74	70	83	2	1	2
8	1	1	1	225	236	239	4	4	6	100	95	86	88	76	85	105	86	2	2	3
8	2	1	1	295	321	308	12	55	5	83	87	98	81	85	85	79	50	4	17	2
8	1	1	1	229	235	222	4	2	0	55	72	45	49	72	70	92	90	2	1	0
8	1	1	1	283	312	333	8	5	3	95	109	109	97	100	88	110	103	3	2	1
8	1	1	1	218	219	225	1	9	2	100	100	95	101	100	95	96	90	0	4	1
8	1	1	1	234	209	237	3	9	13	91	94	55	86	89	95	98	99	1	4	5
8	2	1	1	394	423	3[illegible]	2	16	2	91	89	99	94	98	106	91	80	1	4	1
8	2	1	1	352	340	298	0	16	1	98	100	121	112	112	98	103	103	0	5	0
8	2	1	1	241	250	248	1	63	5	77	72	73	90	92	60	74	95	0	25	2
8	2	1	1	229	246	217	8	3	6	--	82	80	92	82	85	79	95	3	1	3
8	2	1	1	263	299	261	0	0	1	105	109	110	111	107	116	117	116	0	0	0
8	2	1	1	301	218	307	4	0	31	55	67	62	59	79	50	70	60	1	0	10
8	2	1	1	218	231	218	6	6	13	83	72	88	81	87	85	70	77	3	3	6
8	1	2	1	196	155	193	58	10	7	94	92	88	94	76	98	79	73	30	6	4
8	1	1	1	314	296	309	9	59	2	86	94	112	97	98	113	108	108	3	20	1
8	1	2	1	259	222	241	6	6	6	77	73	--	--	--	--	--	--	2	3	2
8	1	1	1	278	328	299	5	8	3	80	78	85	103	98	60	89	90	2	2	1
8	2	1	8	247	273	238	0	0	0	77	85	110	97	105	106	91	90	0	0	0
8	1	2	1	263	269	259	3	5	2	88	81	90	99	100	103	85	97	1	2	1
8	2	1	1	256	278	281	6	7	2	91	93	86	103	96	101	91	88	2	3	1
8	2	1	1	279	267	271	11	2	5	85	88	88	97	89	98	94	113	4	1	2
8	1	1	1	303	374	338	7	18	9	90	90	107	104	105	65	89	88	2	5	3
8	2	1	7	300	348	317	7	13	4	80	86	93	86	103	91	98	90	2	4	1
8	1	1	1	228	218	242	11	4	4	93	86	90	99	89	82	87	90	5	2	2
8	2	1	1	318	359	311	1	3	1	97	88	95	104	105	98	89	92	0	1	0
8	1	1	1	218	261	236	14	9	3	97	101	104	94	109	106	103	86	6	3	1
8	2	1	1	323	304	316	16	51	54	86	86	76	81	92	98	94	99	5	17	17